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DISEASES OF THE NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

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DISEASES of the NERVOUS SYSTEM

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A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

War and Nervous Diseases*

BERNARD J. ALPERS, M.D.
Philadelphia, Pennsylvania

Neurology, like other branches of medicine, has unfortunately profited by war. Unfortunately, because even advances in knowledge are hardly a worth while price to pay for the ravages of war, regardless of what such advances may be. This knowledge would certainly accumulate more slowly in states of peace, but, except for rare conditions, it is a fair conclusion that war brings nothing in the advancement of knowledge which cannot in time be achieved in peace. The tempo of progress is undoubtedly faster because of the existent emergencies, but the direction remains the same. However, it cannot be denied that war creates laboratory experiments in the human in large numbers which are not often reproduced under other conditions, the result being that man is permitted observations of infrequently produced disorders which bring advances in diagnosis and treatment.

The present war is no exception and already the effects of concentration on its medical problems has begun to make itself felt in the many new treatment methods which I shall point out in this contribution.

No figures are available as yet to show the relative percentage of recoveries for various categories of disease in this war as compared with the last World War, but for some diseases such as meningitis there is no doubt that the mortality has been greatly reduced. For some types of injury which requires rapid evacuation, this war has provided revolutionary speed in the transportation of wounded men. Though this is not in itself a form of medical treatment, it is nevertheless of tremendous value, and I believe it can be said without fear of contradiction that the quick evacuation of casualties to front-line hospitals and then to base hospitals in this country and abroad has resulted in the saving of many lives by permitting early treatment when needed—treatment which could not have been available at the front.

Nerve Injuries—Peripheral Nerves

In war 70% of casualties involve the extremities. It is therefore not surprising that injuries of the peripheral nerves are common. Much of our knowledge of peripheral nerve injuries is based upon our experiences with battle casualties. In the Civil War Weir Mitchell and Keen,[1] and in World War I Benisty,[2] and Pollock and Davis[3] have done much to complete our understanding of injuries of the peripheral nerves.

Of the many problems associated with peripheral nerve injuries, that of treatment is paramount, and in no field of medicine is proper treatment so intimately dependent on a clear understanding of the problems of degeneration and regeneration of nerve fibres. For this reason the present conflict has stimulated investigations into the histology of nerve as well as with treatment of its injuries.

* From the Jefferson Medical College, Philadelphia, Pennsylvania. Read at a meeting of the Institute of Medicine, Chicago, Illinois, November 1, 1944.

The return of function of a sectioned or injured peripheral nerve must depend on the regeneration of nerve fibres from the central stump and their growth into proper channels in the peripheral stump, provided with good blood supply and unobstructed by scar tissue or neuroma formation. Investigations into the regeneration of nerve fibres in rabbits indicate that the power of regeneration of fibres of the central stump after section is equally as good if induced long after section or soon after. The inference is therefore that no serious harm results from delay in suture of a nerve, at least in so far as the capacity for regeneration is concerned. On the other hand, the capacity of the fibres growing from the central stump to penetrate the peripheral stump diminishes in the course of time because of the closing of the tubes in the peripheral stump by the proliferating Schwann cells. (Holmes and Young.[4])

A recent study of the factors affecting the recovery of motor function after nerve injuries, reviews some well-established principles and calls attention to new ones as well (Gutmann[5]). Return of function is influenced by the following factors: (1) The level of the lesion. The greater the distance of the injury from the muscle innervated by the nerve the slower the recovery. The power of regeneration is not affected by the level of the injury except that lesions close to the cell of origin are slower to recover than those at some distance. (2) The type of injury. Recovery is materially slower in evulsion and suture than after crushing. (3) Delayed suture tends to retard recovery but the effect is pronounced only when the delay exceeds six months. (4) Infection. (5) Age. Recovery appears to be more rapid in older experimental animals. Apparently interference with the blood supply to a limb fails to affect the recovery of a dennervated muscle.

The ideal treatment of a severed nerve appears to be primary suture provided (1) the nature of the wound is such that primary suture can be performed without fear of subsequent infection (2) the nerve ends can be identified at the time of original debridement and (3) the nerve-ends can be approximated without tension, which assumes that little or none of the nerve has been torn away by the impact. Conditions of warfare are frequently such that primary suture cannot be performed due to extensive injuries to the surrounding parts, loss of nerve structure, and the possibility of infection. Despite these handicaps the present procedure adopted in the armed forces in cases wherein primary suture is impossible consists of the placing of sling sutures of stainless steel between the severed nerve-ends or their anchorage to the surrounding tissue in order to prevent retraction, and subsequent identification roentgenologically, and rapid evacuation of the victims to the interior for operative treatment and the proper post-operative procedures. Every effort is made to repair injured nerves as rapidly as possible in order to avoid irreversible tissue changes. Experiences in the United States Army are similar to those of medical officers elsewhere as indicated by the following report of the Russian Army: "an early operation performed immediately or shortly after the nerve has been injured provides the most favorable conditions for rapidly restoring the function of the injured nerve." (Lebedenko.[6])

Once the nerve has been found ready for repair end-to-end suture is the method of choice although other procedures are possible. The present conflict has developed the use of tantalum wire for nerve sutures, a substance which because of its malleability, strength, and absence of attendant reactions in the tissue has become an important adjunct to peripheral nerve surgery. Of equal importance, and again a development of the war is the use of concentrated plasma and fibrin in the suture of nerves. Concentrated plasma is employed by holding the cut stumps of the nerve together and pouring around them plasma which has been mixed with a little strong tissue extract (Young and Medawar[7]). The result is the formation of a plasma clot in ½—2 minutes, sufficiently firm to hold the stumps together and unattended by tissue reaction. Fibrin sutures have been employed in the repair of nerve injuries in the British forces and have been recommended for the speed

and simplicity of their use especially in primary suture without tension and nerve grafts.

In many instances primary end-to-end suture is impossible and recourse has therefore to be made to secondary suture. Here one immediately encounters problems which have baffled neurologists and neurosurgeons for many years. These are of two types: (1) the length of time advisable to wait before surgery is performed; (2) the nature of the repair, once operation has been decided on. Reasons for delay in suture of an injured nerve present themselves in many guises. It may be necessary because of extensive injury of the bone and soft tissues; or of infection; or suture may be delayed either because there appears to be no return of function and observation is decided upon in order to determine whether function will develop or partial but slowly progressive return of function may be present and delay be decided upon in order to permit as complete spontaneous restitution as is possible. The problems created by the various situations are complex and intricate and unfortunately no specific rules of management can be laid down.

Though experience has demonstrated that no damage results from delay of operation for 6-12 months or even longer, and that the power of regeneration of the nerve fibres is not impaired by such delay, there are nevertheless good reasons for performing operative repair as soon as practical. Among these are atrophy of the dennervated muscle, degeneration of the motor end plates, and stricture of the tubes in the peripheral stump of the nerve. Generally speaking, it appears to be true that experience in the present conflict has resulted in less delay in exploration of injured nerve on the assumption that little harm can be done if nothing is revealed, while much good may result in the disclosure of an unsuspected injury in a nerve which seemingly had undergone spontaneous recovery due to so-called physiological interruption of its function. In this respect the procedure in the present conflict differs from that in others. There is no uniformity of approach however, so that we find ourselves in the same quandary as in previous years—whether to explore a nerve or to wait until evidence of recovery is no longer discernible.

Swan[8] gives the following indications for operation in an injury of a peripheral nerve: (1) Persistence of complete paralysis. If no recovery occurs within five months, operation should be undertaken since "it is during that time one would have expected signs of recovery to have occurred if regeneration is taking place." (2) The palpation of a thickened mass since this indicates that a complete section of the nerve has occurred and the thickened palpable mass is the bulbous enlargement of the proximal end. (3) Failure of progression of recovery in cases which have shown signs of early recovery. Of 133 cases of peripheral nerve injuries in the United States Army (Spurling[9]) it was reported that most of the patients were ready for exploration 3 months after injury and that only rarely was it necessary to delay longer than 6 months. Operations on over 200 peripheral nerve injuries in the Russian army has led to the conclusion that the length of time elapsing before operation should be a matter not of months but of weeks (Lebedenko[6]). The present procedure differs little from that of pre-war days, that operation be delayed so long as evidence of spontaneous return of function is present. The period of delay accepted by neurologists and neurosurgeons is arbitrary and at some variance as shown by the following figures: 4 months, Jaeger[10]; 3½ months Kraus and Reisner[11]; not more than 6 months, Worster-Drought[12]; 2-6 months, Cairns and Young[13]. Opposed to this is the advocacy of immediate exploration in order to determine the nature and extent of the injury to the affected nerve.

The type of operation to be performed once a nerve has been explored depends on many factors. No rigid rules of procedure can be promulgated. In cases with loss of nerve tissue requiring nerve graft, experimental evidence is at hand to show that autogeneous nerve grafts of short length are not inferior in results to end-to-end sutures. Nerve grafting has not been as successful in the human as in the experimental animal. Autografts are superior to homografts and

occasionally an alcohol or formalin-fixed homograft has been successful. The results of nerve grafting must await the test of time, but it is important to note that this war has probably brought out a more extensive use of grafting than at any other time.

An important problem in the repair of peripheral nerve injuries is the prevention of adhesions between the repaired nerve and the surrounding tissues, so that regeneration of the nerve may progress unhampered by scar tissue. This has been accomplished in some instances by wrapping the site of the injured nerve in a sheet of amnioplastin prepared from human amniotic membrane and preserved in 70% alcohol. Gratifying results have been reported in 12 cases (Rogers[14]).

The after treatment of nerve injuries is of considerable importance since it is obvious that little can be expected in the repair of an injured nerve if there is extensive muscle atrophy, ankylosis of the joint, or severe trophic changes. Thus far no new procedures in aftercare have been advanced, but emphasis has been placed on its value. A recent study (Fischer[15], Gutmann and Gutmann[16]) brings out that electrotherapy be given early to denervated muscles, that it must be daily and vigorous, and that the benefits of treatment are directly proportional to the intensity to the point of fatigue. These conclusions are based on animal studies showing that there is less atrophy in electrically stimulated muscles, that there is less fibrosis, a better appearance of the muscles microscopically, and a delayed increase of chronaxie.

Neuritis

In the last World War many instances of acute infectious polyneuritis occurred which excited great interest. In the present conflict a peculiar neuritis of the shoulder girdle has been noticed in many parts of the world. Spillane[17] reports 46 cases in forces in the Near East, developing after recovery from an illness such as dysentery, malaria, gunshot wound, local sepsis, typhoid fever. infective hepatitis, pharyngitis, lobar pneumonia, or cerebrospinal meningitis. In other instances the neuritis developed while in the field. The syndrome is characterized by severe pain in the shoulder and severe lasting atrophy of the shoulder gridle muscles particularly the spinatus, deltoid, serratus magnus, and trapezius. A similar group of cases has been reported in New Zealand forces Brunard and Fox[18]). The cause of the condition is not known.

Painful feet after prolonged immersion in cold water have been observed in many survivors of torpedoed vessels. The pain begins as soon as the feet are warmed after rescue and the benumbing effect of the cold is dissipated. The condition appears to be the result of reduced subcutaneous circulation, due to fibrosis of the subcutaneous tissue and muscle with compression of finer nerve endings and infiltration of larger trunks (White and Warren[19]).

Sciatic Pain and Intervertebral Discs

Sciatica is as diffiicult and baffling in the armed forces as it is in civilian life. The problem of sciatic pain in service men is in some respects less complicated than in civilian life. It is simpler in that the cause of the sciatic pain is more uniform and the difficulty of establishing the cause is to a large extent avoided. There is general agreement that the chief cause of sciatic pain in service men is herniation of the nucleus pulposus (Love[20], Symonds[21]), and that this develops during exertion with the back in flexion. Thus far contributions to solution have been directed mainly to general discussion of the detection and diagnosis of the disorder. By reason of the large number of cases of herniated nucleus pulposus in the armed forces there is an exceptional oppurtunity to study the method of development of the disorder as well as its subsequent course with various forms of treatment. That has impressed many investigators as being the chief cause of sciatic pain in service men.

That there may be other causes of sciatic pain in those who live the strenuous life is seen in the observations of Good[22] who found among 700 cases of back pain, 65 with pain in the leg. He regarded the pain as of muscular origin with well-defined myalgic spots in the quadratus lumborum muscle, the glutei or the tensor fascia lata. Pressure on these spots produced pain similar to that in the leg. Injection of procaine into the ten-

der spots removed both the local tenderness and the referred pain.

There is no doubt about the herniated nucleus pulposus entity as a cause of sciatic pain. The questions presented are how common is this cause and what constitutes the best treatment of the condition. Thus far no statistics are available indicating the incidence of the syndrome among service men. It is not surprising to find that in men engaged in a strenuous life this is the most common cause of sciatic pain. It must be recognized however that this does not reflect the experience of civil practice. Symonds (describing the activities of neurologists in the British armed forces) asserts that in service patients prolapsed disc was by far the commonest cause of sciatica. Thus far no authoritative statement concerning the experience in the United States forces has appeared.

The war offers remarkable opportunity to compare the types of treatment best suited to herniated nucleus pulposus, and to analyze their indications and merits. The present tendency in civil practice is to operate on practically all cases in which the diagnosis is made, but there is room for a wide difference of opinion. The majority of cases will recover with rest, heat and drugs. Symonds asserts that he has observed scores of patients who had recovered after rest and warmth without surgical intervention. This attitude is duplicated in the experience of all neurologists. With regard to service patients Symonds asserts that "he was not yet convinced that operation offered a shortcut to recovery in an attack of sciatica from this cause (herniated nucleus pulposus), or that the prospects of recurrence were any less in cases treated by operation than in medically treated cases. As far as service patients were concerned, operation even in the best hands, had proved on the whole so unsuccessful in getting men back to duty than his present policy was to advise a prolonged period of immobilization and if this failed to render the man fit for duty within a reasonable time, to recommend invaliding."

The management of cases of herniated nucleus pulposus in the United States forces has not been standardized, and it is impossible to know thus far from published writings whether all cases are being operated on or not. Gross[23] reports on 26 patients, 17 of whom incurred their symptoms in the line of duty. All were returned to duty within 8-12 weeks, 18 to full duty and 6 to limited duty.

In view of the fact that many cases recover with rest, heat, and drugs, operation should be reserved only for (1) cases with protracted pain which fail to respond to conservative treatment or (2) cases of acute pain which do not respond in a reasonable time to conservative measures.

Meningitis

There have been no approaches to the problem of meningitis not previously known or available to physicians in civil practice. The war has offered the opportunity to observe the effects of treatment of large groups of cases by means of sulfonamides and penicillin and has permitted studies on the means of control of epidemics.

Meningococcal Infection. Several series of meningococcal infections in troops are available for study. Management of meningococcal infections is much more effective now than in World War I. In 6000 cases over a period of 33 months in World War I a mortality rate of 39% was recorded. Great improvement is found now with the use of sulfonamides, especially of sulfadiazine. In a group of 1935 cases in the Fourth Service Command there were 64 deaths, a mortality of only 3.3%. The death incidence however varied in different posts depending probably on the previous experience of the medical officers, particularly with cases of meningococcal septicemia (Thomas[24]). In Camp Edwards, Massachusetts, 105 cases were treated with no mortality (Hill and Lever[25]). In Fort Bragg 112 patients were treated with 1 death, or a mortality rate of .89% (Daniels, Solomon and Jaquette[26]). Among 100 cases at Fort Eustis there were 2 deaths (Strong and Hollander[27]). On the other hand, a group of cases reported from Australia shows a mortality rate of 10% (Holmes[28]). Among 204 cases in the British Expeditionary Forces in France there

were only 2 deaths (Priest[29]). In still another series of 124 cases 4 deaths were recorded (Cushing[30]). In 100 consecutive cases at Camp Endicott only 1 death occurred (Toranto[31]), and in 50 cases in Portsmouth, Va., there was a 4% mortality. It seems apparent therefore that the mortality rate of meningococcal meningitis can be reduced to at most 1% and in some instances can be avoided altogether except in cases of fulminating meningococcal infection and the Waterhouse-Friedrichsen syndrome.

The lowered mortality rate is attributable partly to the effective use of sulfonamides. Two other important factors are responsible. One is the physical fitness of the subjects and the other is the early diagnosis of the disease. Studies in the armed forces have confirmed the belief that meningococcal infection is primarily a septicemia, with subsequent localization of the infection in the meninges. For this reason it becomes essential to reach a diagnosis early before meningitis is established, or if meningitis is once established, to identify the organism early. In this connection it is apparent that the diagnosis must be made without benefit of laboratory studies. In a group of 112 cases with meningococcal infection 32 had meningococcemia and 82 had meningitis (Daniels, Soloman and Jaquette[26]). Of the 32 cases of meningococcemia only 56% had a positive blood culture. In almost half the cases the diagnosis must be established before the blood culture is positive. This is possible in at least 90% of the cases by recognition of the significance of petechial skin hemorrhages. These occur with almost uniform frequency early in epidemic meningococcal infections and have great significance in diagnosis (Strong[27]). Meningococci were demonstrated in smears from the purpuric lesions in 67.5% of cases of meningococcic infections and in 87.5% of cultures from these lesions (Bernhard and Jordan[32].) Still another sign helpful in early diagnosis is localized pain or tenderness of the muscles and in some instances painful joints.

From the preventive standpoint experiences with meningococcal infections in the Army have demonstrated beyond doubt the value of a concerted attack on an epidemic problem. Mention has already been made of the role that physical fitness plays in the lowered mortality in meningococcal infections in the Army. No less important is the part played by medical officers in calling together all medical personnel at the first sign of an epidemic in order to emphasize early diagnosis. This has undoubtedly resulted in the early detection and hospitalization of many cases which would otherwise have gone unnoticed until frank signs of meningitis had developed. Carriers have been treated by oral sulfadiazine resulting in the disappearance of organisms, but only as long as the medication was continued. There is evidence to indicate that the incidence of meningococcal infection in camps increases with advance in cases among the civilian population (Holmes[28]).

As to specific treatment, there is uniform agreement that sulfadiazine is the drug of choice. Serum has been found unnecessary except in cases refractory to sulfadiazine. In the British forces sulfapyridine has been used frequently with good results. The treatment of meningococcal infection by sulfadiazine is too well known to require review. A few controversial points however deserve mention. It is possible to reduce the mortality to zero if cases are diagnosed and treated early. This often requires recognition of the disease before laboratory confirmation. The method of treatment has varied; some advocate oral and others intravenous treatment, at least early in the disorder. For conscious patients oral use of the drug is efficacious, but the possibility of loss of a vital dose by vomiting must be considered. Moreover, experience has shown that in comatose and fulminating cases intravenous administration is preferable. Kidney complications from sulfadiazine are a danger, since it has been found that hematuria develops in a large percentage of cases soon after the first intravenous injection. This can be avoided by a change to sulfanilamide and alkali (Thomas).

The optimum level of sulfadiazine has not yet been determined. It is claimed by some that if the blood level is maintained at 8 mg. per 100 cc. complications are low; others be-

lieve a concentration of 12-15 mg. per 100 cc. is necessary.

Penicillin has been used less extensively than the sulfonamides in the treatment of meningococcal infections but it appears to be equally efficacious. Of 65 cases of this type in which the drug was used 64 recovered, the one death being in a patient who was moribund on admission (Rosenberg and Arling[33]). Improvement was noted soon after treatment was begun. The drug was given intrathecally, intravenously and intramuscularly. Patients were able to be out of bed on the eighth day unless prevented by complications. The dosage of the drug varied from 20,000 to 900,000 units; 55 patients received between 20,000 and 250,000 units, and 35 received less than 100,000 units.

Pneumococcal Meningitis. In a group of 16 cases treated with penicillin there were 12 recoveries (Cairns, Duthie, and Smith[34]). These cases had previously improved with sulfonamide treatment but penicillin was given because of the persistence of pneumococci in the spinal fluid. The authors advocate the use of sulfadiazine and penicillin in the treatment of future cases. Rosenberg and Arling report complete recovery in one case of pneumococcal meningitis after 3 intrathecal injections of penicillin and 800,000 units of penicillin given intravenously and intramuscularly over a period of 10½ days.

Streptococcal Meningitis. Recovery has been reported in 3 cases of hemolytic streptococcal meningitis treated with penicillin (Rosenberg and Arling) and in 2 cases of streptococcus viridans meningitis.

Head Injuries

Much has been written recently concerning head injuries, but few new approaches to the problem have been uncovered. More has been discovered in the case of open head injuries than in management and diagnosis of closed head injuries.

Concussion.—The war has stimulated investigation of the mechanism of concussion. According to Denny-Brown[35] the phenomena observed in concussion are due to acceleration of the head at the time of impact, resulting in a reflex paralysis of the medullary structures. These two features appear essential for the production of experimental concussion. The sudden acceleration of the head at the time of impact produces the injury; without this factor concussion could not be produced. Concussion as viewed by Denny-Brown, is characterized first by stimulation of the medullary centres, followed by reflex paralysis as evidenced by the gradual fall in blood pressure and sudden respiratory arrest, with rapid vascular collapse and death due to failure on the venous side of the circulation.

Opposed to this view is that of Walker[36] who regards concussion as resulting not from paralysis but from stimulation of the brain. He concludes from electroencephalogram studies that "the electrical accompaniments of cerebral concussion indicate that the process is one of excitation of large masses of neurones within the central nervous system." He suggests that "the physiological basis of discussion consists of the traumatic discharge of the polarized cell membranes of the neuron of the central nervous system by the shaking up or commotion of the brain and that the subsequent course of events is that which would be expected when large masses of nerve cells discharge, such as is seen in the spontaneous or electrically induced convulsive seizure. The concussive syndrome is then to be looked upon as excitatory rather than paralytic."

Important data concerning brain changes in cerebral concussion have been adduced by Groat, Windle and Magoun[37] from experiments with the monkey and cat. It was found that mild but definite changes occur in the brain cells of concussed monkeys, demonstrating conclusively for the first time that quantitative histological changes are associated with cerebral concussion. These consist of chromatolytic changes in certain interneuron systems of the brain stem and of other cytological changes in the pyramidal cells of the motor cortex.

Treatment of Closed Head Injuries

The treatment of closed head injuries in this war differs in no radical fashion from that used in civilian practice, and there appears to be no point in reviewing facts well known to all. There has been considerable revision of ideas concerning the use of hypertonic solutions in the treatment of acute

head injuries. What was at one time regarded as routine procedure is now used more circumspectly and less frequently. The rationale of its use depends on the presence of brain edema in acute head injury, a condition about which there is no unanimity of opinion. Pilcher[38] found no increase in the fluid content of the brain in animals traumatized sufficiently severely to cause a marked rise in spinal fluid pressure. Similarly, Greenfield[39] found no histological evidence of brain edema in 31 brains from cases of cranial traume. On the other hand, others have found brain edema following head injury (Fisanovich[40], Irsigler[41]). In any event, there is reasonable doubt concerning the occurrence of brain edema in head injuries. Few now advocate the routine use of hypertonic solutions because of their temporary effect, the doubt concerning the presence of edema, and the deprivation of fluid in other tissues of the body.

The war has demonstrated conclusively that rigid rules concerning the length of stay in hospital are unnecessary. It has become possible to get patients out of bed in shorter periods of time and there is some evidence to indicate that the incidence of post-traumatic symptoms is less with care of this sort.

The after-effects of head injury constitute as great a problem in war casualties as in civilian practice, with special features added to the problem of the man in service. A study of 237 service men with acute head injuries revealed that 20% were unable to return to duty, as compared with 5% of 158 civilians (Sires[42]). In civilian hospitals 87% of injured return to work within 6 months after their accidents (Russell[43]). There is little to be gained by a strict separation into organic groups and psychogenic groups, or of organic and psychogenic factors in the same individual. Those who have studied the problem in service men have reached the conclusion that all factors must be carefully evaluated and that this must include an appraisal of the pre-morbid personality, the nature of the injury, an analysis of the patient's symptoms, neurological and psychiatric examinations and special studies. The degree of injury seems to play no part in the occurrence of post-traumatic symptoms. The duration of the period of post-traumatic amnesia is a factor in prognosis, the percentage of cases returned to duty being lower with more prolonged amnesia and the percentage of invalidism higher (Symonds[44]). The pre-traumatic personality is also of importance. In 111 cases of acute and chronic head injury in flying personnel of the Royal Air Force, the prognosis for return to duty was four times as good as among other personnel. This suggests that because the flying personnel are a highly selected group in respect to absence of predisposition to mental disorder they are also less disposed to post-traumatic after-effects.

Much can be accomplished in preventing the occurrence of the post-traumatic syndrome by a complete and frank discussion of the problem after all studies have been completed (Symonds[45]). Authoritative reassurance is attested to by many as an important adjunct to treatment and is extremely helpful in many instances. The judicious use of physical and occupational therapy is also valuable.

The electroencephalogram appears to be helpful in the evaluation of post-traumatic states. After cerebral concussion there is a diminution in the electrical activity of the cerebral cortex, the tracings being characterized by abnormally slow waves (Williams and Denny-Brown[46]). Furthermore, the abnormalities of the EEG correspond closely to the severity of the brain injury, being more frequent and more persistent in the more severe cases (Williams[47]). In a group of 87 soldiers and airmen invalided from the service 67% revealed abnormal EEG tracings.

The problem of greatest significance in so far as the EEG is concerned is whether the EEG findings can be used in prognosticating the outcome of cases of head injury. In general clinical improvement of cases of head injury is accompanied by disappearance in the EEG abnormalities, but they may persist in some instances when there are no longer evidences of cerebral disturbance (Jasper, Kershman and Elvidge[48]). The EEG abnormalities persist longer in severe

head injuries, but even here there is a progressive decline in abnormal EEG from 3 months to 2 years after the injury (Gibbs, Wegner, and Gibbs[49]). It is essential to remember that even though the EEG is normal in a post-traumatic case, the brain may be damaged (Gibbs, Wegner and Gibbs[49]).

The problem of post-traumatic *epilepsy* is of outstanding importance. Its incidence is difficult to evaluate, since it has been recorded with varying frequency. The study of epilepsy after head injury requires the passage of a sufficient period of time to permit prolonged observation of results. Hence no observations are as yet available concerning the incidence of epilepsy in the present conflict. There are reports based on studies of casualties in the last World War. Seizures are more apt to develop in cases with penetration of the dura; with laceration of the brain by bone fragments or a missile; in healed brain abscess; and in severe meningocerebral adhesions (Penfield[50]). Seizures are twice as frequent in cases in which the dura has been penetrated (Ascroft[51]). Moreover, patients with retained metal fragments in the brain are less liable to seizures than those from whom fragments have been removed, due to the absence of brain damage caused by surgical removal (Ascroft[51]). Epilepsy does not occur as a rule with closed skull injuries except in rare instances when a dural scar has resulted from contusion; subdural or simple meningitis; and diffuse increase of intracranial pressure as in the case of chronic internal hydrocephalus due to block in the posterior fossa.

Blast Injuries

Despite the importance which blast has come to assume in modern warfare investigations concerning its effects on the central nervous system are relatively few. Blast injuries are of two kinds: (1) those occurring in the air and (2) those which occur in the water.

Atmospheric Blast.—When a bomb explodes in the air there follows a sudden compression of the air in contact with the bomb with the development of an intense blast pressure or shock wave. This wave consists of an initial positive pressure phase followed by a negative phase. In the initial positive phase the pressure rises almost instantaneously to a maximum and then falls to zero, followed by a suction effect which is the result of a wave of rarefaction on the wave of compression (Pollock[52]).

Both in atmospheric and immersion blast injuries to the internal structures are produced with no external evidence of trauma. The seriousness and distribution of the injuries depend on (1) the intensity and proximity of the blast, (2) the medium through which the wave travel, (3) the position of the body and the portion exposed to the wave, (4) the protection offered by clothing, objects, etc. (Theis[53]).

Atmospheric blast is associated with severe pulmonary damage together with injury of the abdominal viscera. There is common agreement in studies of experimental animals and humans that lung injuries are the most severe. Studies of the brain reveal little of significance. In most instances nothing can be found on examination of the brain. In some cases small pial or punctate hemorrhages may be found, neither of them of much significance in the explanation of the effects of blast injury.

A study of four brains in cases which died following blast reveals nothing of significance (Tunbridge and Wilson[54]), have for congestion of the cortical vessels, edema, flattening of the cerebral convolutions and microscopically scattered perivascular extravasation of red cells. In another study of three brains following exposure to blast no evidence of damage was found (Ecklund[55]). Studies of the effects of blast in animals reveals the following (Zuckerman[56]): Hemorrhagic lesions are produced in various organs. The most conspicuous changes are found in the lungs, varying from superficial hemorrhage to hemorrhage which affects the entire substance of the organs. Hemorrhages have also been observed in other organs, around the spinal roots, and occasionally pial and ventricular hemorrhage in the brain. The thorasic and abdominal lesions are due to the impact on the body wall of the pressure component of the blast wave.

Despite the absence of damage to the brain in the majority of cases, instances

have been reported of neurological sequelae after blast exposure. Headache is a common symptom and may be transient or it may persist for weeks after all other symptoms have disappeared. Backache is common. Personality changes and confusional states are sometimes quite severe and the development of an organic mental syndrome with confusion, memory disturbances etc. has been recorded (Anderson[57]). Subdural hematoma may apparently develop following atmospheric blast injuries (Abbott, Due and Nosik[58]), but the clinical features are not distinctive. The story of exposure to blast is loss of consciousness lasting a few minutes to several days, persistent headache, convulsions and personality changes. Neurological findings are absent in 80% of the cases and when present consist only of a slight facial weakness, transient hemiparesis, and occasionally transitory reflex changes. The spinal fluid has been found xanthochromic in some cases of atmospheric blast (Stewart[59]). The cases of subdural hematoma occurring with blast offer an opportunity for disclosure of new mechanisms in the production of subdural bleeding, but thus far there is no clear idea as to how subdural hematoma develops following blast injury.

Immersion Blast.—The problem of immersion blast differs from that of atmospheric blast. The portion of the body submerged in the water is more seriously injured than that exposed to air, and the surface of the body toward the source of blast is injured more severely than that portion away from the blast. The assertion is made that in contrast to atmospheric blast, the greatest damage in immersion blast is to the abdominal rather than pulmonary organs. That this is not the case is revealed by animal experiments (Clark and Ward[60]) which demonstrate severe hemorrhage in the lungs, with secondary changes in the abdominal viscera. These findings have been confirmed by others (Cameron, Short and Wakely[61] and Grover[62]). Damage to the brain is not a significant feature of immersion blast. In guinea pigs epidural and subdural hemorrhage was produced if the animals' heads were submerged at the time of explosion (Grover).

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Sudden Extrusion of An Intervertebral Disc*

HAROLD C. VORIS, M.D.
Chicago, Illinois

While protrusion or herniation of an intervertebral disc has been known as a pathologic entity for the last fifty years, it is only during the last ten years that the clinical entity of small protrusions of a lumbar intervertebral disc has been established and its treatment relatively standardized. It is well known that recurrent pain of the so-called root type is the usual complaint; rarely does the patient present gross neurologic defects. Protrusion from discs above the lumbar level are most likely to cause gross neurologic defects by pressure on the spinal cord, simulating cord tumor. (Stone[1].) Even at these higher levels it has recently been recognized (Semmes and Murphy,[2] and Spurling and Scoville[3]) that a small lateral protrusion of the intervertebral disc may cause a syndrome of root pain with minimal objective neurologic findings comparable to the classic syndrome at the lumbar level.

In the early literature on this subject these disc protrusions were often reported as chondromas and were thought to be neoplasms. They were not recognized clinically unless they had produced extensive neurologic symptoms. Thus in 1911, Middleton and Teacher[4] reported a case of protrusion of a lumbar disc with paraplegia. Patient died of urinary infection. Dandy[5] in 1929, reported two cases he had operated on, both with a large piece of loose cartilage in the spinal canal opposite the third lumbar interspace. Both were paralyzed and both recovered after operation. French and Payne[6] recently reported eight cases of disc protrusion with moderate to marked disability.

I wish to report two cases of massive extrusion of a portion of the third lumbar intervertebral disc with sudden paralysis in each case.

Case I: M. C., a punch press operator, 45 years of age, had suffered from recurrent low back pain for twelve years. He had been treated more or less continuously for spinal arthritis. Two weeks before, he commenced to have pain radiating into the left lower extremity but was able to continue work until five days later when on arising in the morning he was paralyzed from the knees down. Since that time urinary retention and fecal incontinence developed and the patient became bed-ridden.

Neurological examination revealed weakness of the thigh muscles with paralysis of the calf and peroneal muscles. The right knee jerk was active, the left absent and both ankle jerks absent. Cutaneous sensation was lost over the posterior aspects of the buttocks and thighs (S3-5 dermatomes) and impaired on the posterior aspects of the legs, over the feet and the anterior aspect of the lower third of both legs (L4-S2 dermatomes). There was an area of hyperesthesia to pin prick on the dorsum of each foot. Vibration sense was moderately impaired at the left ankle and slightly at the right. Position sense was impaired in the left toes.

A neurological consultant had performed a spinal puncture and injected lipiodal. He had not obtained fluid at the third or fourth lumbar interspaces but had obtained xanthochromic fluid that coagulated on standing at the fifth lumbar interspace. No rise in spinal manometric pressure had been noted on bilateral jugular compression. X-rays taken after this injection of lipiodal at that level showed all of the lipiodal below the lower part of the body of the fourth lumbar vertebra.

The pre-operative diagnosis was tumor of the cauda equina opposite the third and fourth lumbar vertebra. Operation was performed consisting of laminectomy of the spines and laminae of the third, fourth and fifth lumbar vertebra. When the lamina of the fourth lumbar vertebra was removed on

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* From Mercy Hospital—Loyola University Clinics. Read before the Central Neuro-Psychiatric Association at Chicago, October 31, 1944.

the left side, a tightly rolled extradural mass extruded itself and spontaneously unrolled. It proved to be a ragged piece of fibrocartilage 4.0 x 2.5 x 0.7 cm. (fig. 1). Its inferior and anterior corner was still attached to the intervertebral disc between the fourth and fifth lumbar vertebrae. It was readily removed. The ragged cavity in the intervertebral disc proved to contain no loose or fragmented cartilage. The dura was opened and the previously injected lipiodal removed. The nerve roots were swollen and markedly injected.

Convalescence was uneventful. At dismissal from the hospital three weeks later bladder function had satisfactorily returned but the neurologic status was otherwise unchanged. Nine months later he was walking well with only moderately diminished strength and tone in the calf muscles. The left patellar reflex was diminished. Both ankle jerks were present but diminished. Sensation was still impaired in the third to fifth sacral dermatomes bilaterally. The patient claimed no difficulty with bladder function but admitted some difficulty in controlling the rectal spincter. Four years later he reported good control of bladder and bowels, residual atrophy of the calf muscles, and complained only of easy fatigue in his lower extremities. He estimated his percentage of recovery at 90 per cent.

Case II: E. H., a 45 year old priest had been suffering from low back pain at intervals for ten years with recurrent left sciatic radiation for a year. He had been admitted to a hospital for physiotherapy because of a current exacerbation of his sciatica. Three days before while at stool he coughed. He was immediately seized with excruciating pain in his lower back and lower extremities and had to be helped to his bed. Since then his lower extremities had been paralyzed and he had lost control of his bladder and bowels. Severe paroxysms of pain in his back and legs were initiated by any movement of the body or by coughing or sneezing.

Neurologic examination revealed bilateral weakness of the posterior thigh muscles and complete paralysis of the muscle groups below the knees and of the gluteal muscles. The ankle jerks were absent; the knee jerks diminished bilaterally. Position sense was absent in the toes. Vibration sense was slightly impaired at the ankles. Cutaneous sense was lost on the left below the third lumbar dermatome and on the right below the second sacral dermatome. It was also impaired on the right below the third lumbar dermatome. On multiple spinal punctures clear fluid was obtained at the first and second lumbar interspaces with no evidence of subarachnoid block. A puncture at the third lumbar interspace failed to yield any fluid. The spinal fluid that was obtained at the first lumbar level contained 40 mg. of total protein, that from the second lumbar 50 mg.

With the case of M. C. in mind a diagnosis of massive extrusion of the third lumbar intervertebral disc was made and immediate operation advised. Laminectomy of the spine and laminae of the third lumbar vertebra revealed the presence of a firm mass anterior to the dural sac and lying more to the right. Retraction of the dural sac exposed a large ragged piece of fibrocartilage lying free in the spinal canal (fig. 2). This was removed and after control of extradural oozing it could be seen that this cartilage had extruded itself from the third lumbar disc.

The patient's convalescence was uneventful from the general standpoint. An indwelling catheter was no longer necessary after the third post-operative week. On dismissal on the thirty-fifth post-operative day, sensation on the left had recovered except for the perineal region; on the right it was still impaired below the fourth lumbar dermatome. He was walking with the aid of braces to correct the bilateral foot drop. When last seen six months after operation sensation was present everywhere although there was still considerable weakness of dorsi-flexion of the feet. Power in the calf muscles was good but ankle jerks were still absent. Complete recovery will probably take place in time.

These two cases of sudden massive extrusion of a large portion of an intervertebral disc with resultant paralysis of the cauda equina do not represent a new clinical syn-

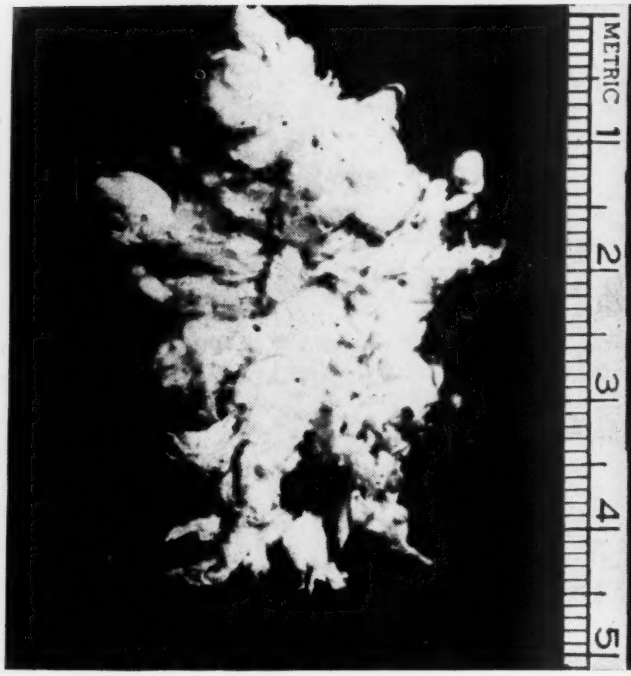

Figure 1. Operative specimen case I.

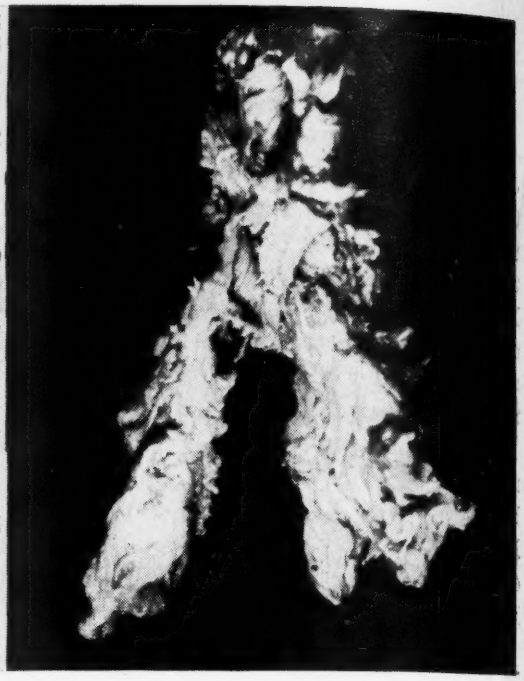

Figure 2. Operative specimen case II.

drome. They are presented however in order to call attention to a rare but possibly serious disabling complication of the usual intervertebral disc syndrome. One cannot truthfully say to patients with the usual clinical picture of a small protrusion of an intervertebral disc: "You are in no danger of neurologic disability." Admittedly the risk of such disability is small but it should not be forgotten.

The mechanism of such sudden massive extrusion is not clear. One would expect it to follow severe muscular effort or strain. One of these patients did cough while straining at stool but the other was paralyzed on awakening from sleep.

Both patients had had a long history of recurrent low back pain with recent sciatic radiation in one and longer sciatic pain in the other. Examination of both patients before the onset of paralysis might have revealed the classic syndrome of protrusion of a lumbar intervertebral disc. Both of these extrusions were from the third lumbar disc, one much less frequently involved than either the fourth or fifth.

The sudden onset of paralysis of the cauda equina, especially in a patient who had low back pain with sciatica indicates massive extrusion of a lumbar intervertebral disc. Because of our ignorance of this a correct pre-operative diagnosis was not made in Case I. The use of contrast myelography should not be necessary. Clinical neurological examination plus multiple spinal punctures with manometric readings should adequately localize space-occupying lesions in the lumbar spinal canal that produce complete or partial block.

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Social Readjustment of Returning Veterans*

LUTHER E. WOODWARD, Ph.D.
New York, N. Y.

In this paper it is my intention to discuss, as I see them, the necessary social readjustments of all groups of veterans, not only those who are returning for neuropsychiatric reasons. Further I prefer to emphasize the adjustments which groups of veterans returning now have to make, rather than to project ourselves far into the future. There is at least one difference, in that most of the men coming back now either have some disability or somehow did not fit into military life. That doubtless will not be true at the time of general demobilization. The justification for focusing on the present situation is that the adjustments which will have to be made in the postwar period will depend largely on how well we deal with interim problems and how effectively we plan to solve those of the postwar period.

The Veteran's Adjustment to Civilian Status

The first and perhaps biggest adjustment every veteran has to make is his readjustment to civilian life, involving his outlook, habits, attitudes and acceptance of civilian status. In doing this, of course, he has to adjust to civilians who stayed at home.

Military life is so different from ordinary civilian living that it has an influence upon all men. It breaks some men during training or combat or gets in their blood and leaves a profound impression. In both instances, men returning from military service are faced with serious problems of adjustment.

A brief but apt quotation will make clearer the reasons for the breakdown of some men during training, and give a proper emphasis to the inevitable adjustments which men have to make in coming out of the military establishment.

"At home we 'live by work, play, love and worship,'[2] or some other combination of interesting and zestful activities. As civilians, we channel our lives in ways that bring us many kinds of satisfactions. Some of our sense of well-being and security we get out of work and of earning. Some we get from the affection and the give and take of family life. Reaction supplies other satisfactions, and we give ourselves to causes designed to improve our own lot and that of our fellows. We all have a good measure of freedom in the things we do and the ways we do them. We can choose the people we associate with. We can join the crowd or be alone if we prefer.

"It is not so in military life. The sailor must live his whole life on a ship; the soldier has to become a small cog in a huge machine. He must live with masses of men; he cannot choose any one of the 200 bunk mates in the same barracks. He must wash in a crowd, eat in a crowd, sleep in a crowd. There are no private facilities. He must undergo rigorous discipline involving physical strain, which may prove too much for his heart, feet or nerves. If he learned very early to rely on himself and developed a knack of adjusting to all sorts of people, he can make the shift to military life without too much trouble. If he is over-conscientious and meticulous, if he has to eat certain foods and do things just certain ways, if he is too dependent on mother, wife or sweetheart, if it irritates him to mingle with large numbers of people, or if he has trouble taking orders and getting along with the boss, it's tough to be in the Army, where he has many bosses and cannot choose any of the conditions under which he lives.

"Some splendid, conscientious people, who have unusually high standards for themselves and do excellent work in civilian occupations, find it extremely hard to fit in. In fact, some whose peculiarities and differences make them especially talented in their civilian occupations quickly become very upset in the armed forces. This is true of some artists and writers, of some leaders in business and industry, of some of our most skilled and precise technicians, and of at least a few in the learned professions. Under the weight of so many changes they fail partially in the performance of some duty and get a bit of criticism or ridicule; then a vicious circle of worry and more failure and illness may be started. Many men discharged because of psychoneurosis are of this type. They may have tried very hard, but they are not fitted for soldiering."

Most of these men who could not make the necessary adjustments and are discharged during the training period come back with a deep sense of having failed. They do not realize that their disabilities are of the nature of specific vocational limitations—that they are not fitted for soldiering, just as others could never become musicians or mathematicians. Not appreciating this they simply regard themselves as failures, and are very much ashamed on this account. Sizeable numbers of them feel this chagrin so keenly that they resist returning to their home communities and seek to establish themselves elsewhere.

To quote further from our recent pamphlet for families of returning service men:

"By the time others, who make up the majority,

* Address delivered before the Graduate Assembly on Nervous and Mental Diseases sponsored by the Institute of Medicine, Chicago, Illinois, November 2, 1944.

go through basic and advanced training, military life has become part and parcel of their being. For some the excitement and the companionship with many men of similar age and interests get in their blood so much that life back on the farm or in the home town appears very dull. Regimentation and close scheduling is no longer annoying. It is the accepted order and their accustomed mode of life. All their energies are given to making their part of the machine work perfectly. Each man finds his niche and fills it. No thought need be given to daily schedule. There is need for few decisions. Everything is well organized. The machine operates with smoothness and precision. Working in units, the men feel their combined strength but lose much of their individuality. After months of military training and experience, the choices, freedom and variety of civilian living seem remote and dreamlike.

"This is especially true of men who have seen protracted periods of active combat. Fighting in jungles where an enemy may lurk in every treetop or clump of underbrush, dive bombing out of the skies with flack flying everywhere, and fighting off the enemy at sea, all have an absorbing reality which makes one's normal past fade into oblivion. The peaceful ways of the home community can have little meaning for men who must live and sleep in soggy foxholes, eat K rations and dodge fire from the air, from distant artillery and from snipers nearby; for men who must crawl cautiously through barbed-wire entanglements and over mined roads where a single slip is fatal; for men who engage the enemy in desperate hand to hand combat and see their pals blown to bits; for men who fight on with fury, notwithstanding the deafening din of bursting bombs and shrieking shells, and the sickening smell of death all about them. Men who have endured such strains cannot blot out their memories or suddenly drop their habits. There are scars of mind and emotion, as well as of the flesh.

"To return from military life to civilian occupation and normal family living involves many adjustments. The returned soldier or sailor must again learn to make decisions and regulate his schedule. He misses his many pals in his outfit. He must pick up with old friends or make new ones. Scenes in the home town were almost forgotten, and he has a great need to go back to the old places and see the people he knew before the war. Without the crowd, the excitement, the orders and the one undivided cause, he is apt to feel lost. He may find it hard to talk to women and to play with children. There is no chance to use military skills and he is out of practice at most of the things civilians are doing. If he worked before he went into the Service, he feels as he used to at the end of a vacation, only more so; the job seems strange and he has to learn it all over. A few things are the same, but most things are a bit strange. Days seem uneventful. Love and laughter require effort. It's hard to show feeling the way the homefolks do. Things just don't click at first. It soon becomes clear that, just as he had to learn how to become a soldier or sailor, he now has to learn to live as a civilian."

They not only are faced with practical problems—many of them also experience a great deal of emotional stirring and turmoil. They are glad to be at home and yet often wish they were back with their units. Some of them are disappointed in finding things at home or at work less ideal than they had imagined when they were in far-off battle zones. Many feel unexpected restlessness, irritability or boredom. Some find it hard to concentrate or to settle down to a task.

Still more difficult adjustments have to be made by men who are handicapped by physical wounds and scars. They have the serious problem of maintaining a healthy and constructive attitude toward themselves, and of seeking and carrying through necessary treatment, or of becoming reconciled to conditions which cannot be remedied.

Men suffering from psychoneurosis, or even from physical disabilities that cannot readily be seen, have a hard time indeed. They feel ashamed and fear that more may be wrong with them than the records indicate. While their nightmares and nervous indigestion are extremely real to them, their conditions are not obvious and are difficult to explain to family and friends. Many men fear they may be regarded as 'yellow.' Life at home is filled with embarrassment and loneliness for many of them. They do not feel free to use recreational facilities intended for men in uniform, and it is difficult to find companionship. Many of them become disheartened or tired of having their lives pried into, and carry a chip on their shoulders. Dissatisfied with themselves, some of them set training and job goals far above what they actually can do.

The degree of social adjustment which these men make and the speed with which they do it depend to a very real degree on the understanding they find among civilians and on the way in which the people at home treat them. With understanding, reassurance and constructive treatment, many of them achieve acceptable status and carry on quite effectively after an adjustment period of a few weeks or months. This happens only when they are understood and rightly treated.

These are some of the things that help:

1) Giving them a genuine welcome and making them feel wanted. The sort of welcome which most men want is that of a quiet personal reassurance, rather than family reunions and a lot of fanfare.
2) Understanding listening on the part of the folks at home and careful avoidance of prying into their personal experiences while in the service. Many men have

real fear that they will be asked embarrassing questions.

3) Readiness to face the reality of disabilities with as much objectivity as possible. It is futile to attempt to ignore a serious wound or scar. But we should not magnify these, and should focus on what is left, rather than on what is lost. In other words, we should treat them as essentially normal, upstanding, competent people, not as invalids.

4) It helps much to commend their efforts, acknowledge their successes and ignore the slips. This is sound mental hygiene method with anybody at any time, but it is particularly valuable for men who come back feeling somewhat insecure.

5) It should be expected that veterans will be different in some ways, and time should be allowed to get acquainted again and to find ways of getting along together. There should also be time and freedom for getting acquainted with the old places and re-establishing old contacts, for the need for this is often acute.

6) In general, civilians can aid greatly by creating an atmosphere of expectancy, by encouraging the men to take up their old hobbies or sports, to go back to work as soon as they are able and to resume normal social activities. Care must be taken to avoid pushing or regulating these men, for they will not tolerate it. Their need is for encouragement and reassurance, and in some instances for professional help, which should be made available to them promptly.

Other adjustments have to be made because the men return to situations that have changed. Frequently there are changes in family life, in their work situation and in their community status.

Readjustments to Family Life

The young man who married at the time of enlistment or while on furlough returns to a new situation. He and his wife have had no chance to work out a real and abiding adjustment. During his absence they have idealized each other and remember only the peak experiences of love and enjoyment. This idealization had positive value at the time, and helped to keep up the morale of both. Soon they discover, however, that neither is 100% sweetness and light, that each has personal desires and habits, and that both of them have become more set in their separate ways. Now, for the first time, they have a chance to develop deeper understanding, learn the art of congenial give and take and really become a family. The wife will have to guard against being too possessive, and her soldier husband will have to appreciate the naturalness of this tendency, in view of their long absence from each other. She may well expect that her husband, who has been associating with men almost exclusively, will still want to visit his pals and spend some of his time outside the home. If she is angry about this, or regards it as lack of devotion, she may drive her husband away. If she accepts it with good grace and shows wifely attentiveness when her husband is at home, they can likely build a congenial family life in a little while.

Fathers, too, may have a problem of readjustment to family living. Those who return to see their offspring for the first time have had little preparation for playing the role of a dad, for they missed the opportunity to deal gently and providently with the expectant mother. The young father who greatly missed his wife while in the service is apt to focus his attention on her, with the result that the child feels left out in the cold and robbed of his mother's affection. Jealousy and anger toward him are to be expected, unless affection and reassurance are given the child. Other fathers find their formerly well-disciplined children have gotten somewhat out of hand, or that the children have grown up beyond all expectation and are strangers to them. They must then earn the children's confidence and learn their ways all over again.

In these types of situations, understanding and tact on the part of the wife aid the veteran in his family adjustment. The wife who became accustomed to managing family affairs on her own will have to be careful to avoid the dual danger of ignoring her husband and of controlling and regulating him. She will have to give him a sense of importance in the family, invite him to take part in arriving at the numerous daily decisions which have to be made, and give him plenty of opportunity to participate and regain his position as head of the house. Other wives will have to avoid suddenly unloading on

their husbands all the duties which they have borne. The man who has not been in a position to carry any family responsibilities for two or three years may find such unloading too much, along with all his other adjustments.

The adjustment of the very young men will be aided by constructive attitudes on the part of their parents. Boys who entered the service at 18 may have matured beyond their years. Parents will need to appreciate this growth and treat them as grown-up men. There should be warmth of feeling in the relationship, but on a mature level.

Readjustment to Civilian Employment

The need for full employment is basic for the adjustment of veterans in the postwar period. In fact, the mutual adjustments of veterans and civilians will probably depend more on this than on any other single factor. It is conceded by everyone that full employment, congenial working relationships and genuine job satisfactions contribute much to the mental health and social adjustment of workers, not only while engaged in work, but in off-duty hours as well, and also to the mental health and stability of their families. This is true of everyone from the high-salaried executive to the lowest-paid unskilled workman.

The three million men who went directly from school into the armed forces are particularly concerned about employment. For them it will be a new experience. Many of them share the concern of one who put it this way: "I was scared when I entered the service, because I just knew all those regulations and orders would be more than I could understand; now I am just as scared (after three years in the Navy, with service in two major zones) when it comes on me that some day I'm going home to find a funny kind of a job, and wear ordinary clothes again, and learn to drive a car, and to try to sleep in a room by myself where it will be quiet and still. I tell you, it's going to be worse than funny—it's going to be tough on us young fellows." They fear, too, that women will have all the good jobs, because they work for less than men, and that there won't be much opportunity for the fellow who has "no job to which he may return." The Selective Service Law holds no guarantee for them.

Others return to face a changed status, compared with that while in the service. Some who worked at relatively insignificant jobs before going into the service have risen fairly high in military ranks, and have become accustomed to carrying responsibilities and receiving salaries far beyond their former civilian pay. In the service, some of them have acquired new skills which have no counterpart in civilian employment. For example, it is estimated that probably not more than 10% of the men in the air corps will be able to obtain employment in the aviation industry. There are few civilian jobs for the expert gunner. Employers are always on the lookout for capable men willing to assume responsibility, and they doubtless will give employment to some of this group who have acquired higher status. Many others will face the necessity of accepting work and pay at a lower level, at least for awhile. This will be particularly true of those who have become physically or mentally handicapped.

Further Education

Many men whose education was interrupted experience considerable conflict when they return. They feel they have given up two or three years of their youth and are that much behind their fellows who stayed at home. They want to earn as much as possible, and many of them want to establish families. At the same time, they realize the need for adequate training for long-term civilian employment. Some observations at the University of Minnesota suggest that the return to student life is somewhat difficult for many men, and that for awhile their scholastic achievements are scarcely up to standard.

In this connection, it seems that the colleges, universities and technical schools will have to do some of the adjusting. Veterans already fed up with regimentation will not tolerate what appears to be unnecessary red tape and "wasting of time" on courses that seem to have no other value than to help meet degree requirements. Veterans are demanding courses which prepare them for jobs and for daily living, and they want to complete their education with as much speed as possible. It is hoped that our institutions of higher learning will at least meet the veterans half way, otherwise we may expect a mushroom growth of fly-by-night schools which will claim to give them what they want, but will exploit them at the same time.

Readjustment to the Total Community

It is already clear that if veterans are to have maximum opportunities for adjustment upon their return, the community must do some sound planning. Fortunately, demobilization, reconversion of industry, the movement of war workers and re-assimilation of veterans, are receiving serious thought, not only by us in health and social work, but by Government, Management, Labor, educators and others.

In the fields most represented here, namely, health and social work, it is clear that we must co-ordinate fully the services which are now operating and those which are being planned. So many organizations are interested in service to veterans that marked confusion results unless there is thorough co-ordination. We must keep our focus on services needed and carefully avoid promoting any organization at the veterans' psychological expense. This is truly important from the angle of mental health. If, upon return from the armed forces, men find organizations in their home communities wrangling and fighting over services to veterans, they rightly feel that they are being exploited, properly resent it and wonder if that is what they were fighting for. On the other hand, if the total community is well organized to aid them in ways that are genuinely helpful, this boosts their morale and reassures them that they have not fought in vain.

If the familiar "run-around" is to be avoided, a sound and economical information and referral service must be established in each community, for we have not educated our people sufficiently well to enable them to know where to go for what unless we give them assistance. In establishing such centers, all groups having an interest in service to veterans should be represented in the organizational structure. If this is not done, resentment and opposition by one or another group and competing programs are almost sure to result. It is helpful, too, to have one or more veterans of this war on the governing board or committee.

A second essential is to employ well-trained and experienced interviewers and counselors. The problems of veterans are frequently complex. The apparent problem often is not the real one. The unskilled counselor will too often miss the real issue and unwittingly send the veteran to the wrong place. From visits to many cities in which such centers have been operating, it is clear that inclusiveness of organization and skill on the part of the interviewers provide the clue to success. When these principles are observed, centers are used increasingly and with satisfaction to those served; when these principles are ignored, centers tend to be used less and less.

Inasmuch as 20% to 45% of medical discharges from the various branches of the armed forces are for neuropsychiatric reasons, planning must be done to make clinical treatment available to as many of these men as possible. Many of our clinics are understaffed because of the large numbers of psychiatrists, social workers and others in the service. There simply isn't skilled personnel with which to establish new clinics, but it is incumbent upon us to make the most of what we have. Many communities are finding it practical to draw together psychiatrists, social workers, neurologists, and occupational therapists from wherever they can be found, teaming them up as a special staff for rehabilitation work. Most such clinics operate only one or two evenings a week, and while this sounds inadequate, it is surprising how many men can be seen and helped. Fortunately, a majority of the men seeking help respond well to short-term treatment or to group therapy methods. In a recent study[3] in New York City it was revealed that only one-fifth of those who recognized the need for treatment were actually receiving it. In many communities the proportion is doubtless even lower.

It appears to me that in dealing with this problem we shall have to do as the Army and Navy have done. That is, attempt to increase the understanding of the total group of men and provide practical first-aid measures in mental health. A necessary feature in such an effort will be, of course, the education of the public regarding the nature of psychoneuroses and other nervous ailments, as a means of removing the present fear and shame which in the minds of many is associated with nervous or mental disorders. The National Committee for Mental Hygiene is making some efforts along this line, but every community will have to do its part.

In all our educating and planning, I think we need to observe special caution to pre-

vent or to keep to a minimum cleavage between veterans and civilians. Veteran consciousness is perfectly natural, and it requires a high degree of objectivity for veterans to avoid resentment toward civilians who appear to have profited by the war, rather than to have sacrificed for it. A policy of including war workers and other civilians in all the community's services helps, as this emphasizes common needs and goals. There is some justification for segregating veterans in rehabilitation clinics, where ex-servicemen suffering from nervous conditions can be effectively treated in small groups. The fact that all the men have veteran status proves to be a definite advantage, but for most services, veterans, war workers and others need not be separated. Counsel relating to family problems, employment, health, etc., are needed by many citizens, regardless of veteran status. It would be a serious mistake to allow our patriotism and our debt of gratitude to veterans to run rampant to the extent of creating cleavages between them and the rest of the community. We will not have done the whole job of veteran-civilian readjustment until the two groups go hand in hand in facing the problems and doing the work of tomorrow.

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Neurological Clinical Pathological Conference

of the

Cincinnati General Hospital

CHARLES D. ARING, M.D., *Editor*

CASE No. 103195

Presentation

A 24 year old single colored girl, employed as a maid, was admitted to the Neurological Service on September 6. While going to work on the previous morning she noted that her left lower extremity suddenly began to drag. She was able to get on a bus to go to work, and there noted that dishes would fall from her grasp if she attempted to hold them in the left hand. On manipulating the left fingers she found that they were stiff. She was able to get through the day's work and to her home that evening. There the family noted that the left grasp was extremely weak and that she stumbled on going upstairs. Her family massaged the left extremities and she went to bed, and apparently slept well the entire night. She awoke on the morning of September 6 having considerably more weakness in the left extremities than she had had on retiring. Her menses accompanied by dysmenorrhea had begun on September 3; the pain had been eased with acetylsalicylic acid. The past history was singularly free from any disorder except for urinary urgency and frequency, which had always been present according to the family.

The only abnormal findings on the admission examination were those associated with left hemiparesis. There was moderate to marked weakness of all movements of the left extremities, and of the lower portion of the left face. The resistance of the left extremities to passive movement was increased slightly. She reported that pinprick was better perceived on the right side of the face and trunk, and in the right extremities than on the left, and that the pin on the left felt definitely abnormal and "stingy." The left corneal reflex was reduced slightly. The deep reflexes were hyperactive, those on the right slightly more so than those on the left. The left abdominal reflexes were absent. The left plantar responses were extensor.

The pulse rate ranged around 90. The blood pressure was 138/76. The cerebrospinal fluid was completely normal, the blood Kahn was negative. The urine, stool, and blood examinations were normal. An electrocardiogram showed sinus tachycardia (rate 140 per minute). The T waves were of low voltage, the PR interval .14 seconds; low voltage T2, 3, and 4; and Q waves were absent. The record was interpreted as indicative of myocardial damage.

The patient remained in the hospital until September 10. The strength in the left extremities improved slightly during the five days in the hospital, but she never was able to walk without assistance, and she dragged her left foot along the floor.

The family noted that she never was able to return to work after her discharge from the hospital on September 10, since the entire left side remained paretic. She could move her fingers and her left leg, but she could bear no weight on the latter member; when she stood she had to hold on. She was visited repeatedly by a private physician, who told the family that the patient had "creeping paralysis," and that she would be helpless within a relatively short period of time. In late October her left great toe would go into spasms of dorsiflexion and according to the relatives would cause the patient considerable pain; she would scream during these episodes.

For a few days before her re-admission to the General Hospital in early November she was delirious. The weakness which had been limited to the left extremities and face spread to involve the right limbs a week or two before the re-admission. She became unable to feed herself, and though she could move the fingers slightly she could not use the hands, and was unable to lift either arm off the bed. About November 1 she became incontinent of stool and urine. She was readmitted to the Cincinnati General Hospital on November 5. At this time she was relatively unresponsive. She was listless and dull. She seemed to recognize that questions were being asked and tried to answer, but she usually ended with stereotyped exclamations. At times she answered questions, but for the most she gave fragmentary responses and these stereotyped; on some occasions she was considered to be aphasic. Speech was slurred. Sometimes she broke into laughter on questioning or during examination. There was increased tone in all of the extremities, much more marked on the left. She was occasionally able to move one extremity or the other, and it was determined that all the extremities were considerably weakened. There was weakness of the right lower face. She could not sit up without support. It was practically impossible to test sensation. Once she said "needles and pins" when sensation was being crudely tested, but she did not react. At other times she was thought to appreciate pinprick. One examiner noted that she did not blink at objects approaching from the right, but did when they approached from the left; others thought the visual fields were normal to confrontation tests. The deep reflexes were hyperactive. The abdominal reflexes were absent. There was bilateral forced grasping. The Hoffmann responses were obtained bilaterally and the plantar responses were extensor, more obviously so on the left.

On November 8 she used the correct words in singing songs, and she was able to move her upper extremities fairly well. She had a few of the cramping spells in the left great toe, about which the relatives had informed us. At times she would moan and whimper, and usually she was unable to turn herself in bed. For the most her extremities rested in flexion and were spastic. Attempts to straighten a flexed extremity resulted in moans. Drooling of saliva was occasionally noted. Stertorous respirations with a rate of 44 and accompanying pulse of a rate of 140 made their appearance on November 11. Thereafter the temperature and respirations, which had been relatively normal rose steadily, and the patient refused nourishment. The neck and trunk became rigid. She was noisy at intervals and stuporous at other times. After November 11 parenteral fluids had to be administered. She continued in an extremely precarious condition until November 16 when frequent convulsions were noted. Signs of lobular pneumonia

made their appearance about four or five days before death. On the last day of life she was seen to chew her tongue. She became comatose on November 13, and cyanotic on the 15, at which time she was placed in an oxygen tent. She died on November 17, 74 days after the initial symptom of her final illness.

Laboratory Data: The rectal temperature ascended from normal on November 5 to 103° F. on November 11. Thereafter it ranged between 104 and 106°. The respirations, which had been between 20 and 30 a minute from November 5 to November 10, rose on November 11 to 40, and thereafter ranged between 40 and 70, remaining around 65 during the last two days of life. The pulse was always fast, ranging between 110 and 130 from November 5 to November 10. Thereafter it ranged between 150 and 170. Her blood pressure was 145/80 taken on several occasions. Analyses of the blood were normal. The final white blood count was on November 14 and was 9300. The urine was normal. Three analyses of the cerebrospinal fluid done on November 5, 12, and 17 were completely normal. Blood cultures taken on November 11 and 16 were negative. Roentgen examination of the skull was normal. Examination of the chest on November 11 (with the patient on a stretcher) showed the heart to be markedly enlarged to the left with some increase in hilar marking bilaterally.

Differential Diagnosis

Dr. Harry M. Salzer: The only abnormal findings on the initial examination were those associated with the left hemiparesis. An electrocardiogram showed sinus tachycardia when the rate was 140 per minute. As the patient improved she became able to move the proximal portions of the left extremities.

The stereotyped exclamations on the second admission might suggest that she had dysphasia. Two days after the second admission, she was able to use correct words in singing, as may occur in aphasia. Speech was slurred, and there was some drooling of saliva which would make one suspect difficulty in swallowing. Her emotional behavior may have been that of pseudobulbar palsy. She occasionally was able to move an extremity.

Let us consider the location of the lesion or lesions. The patient at first had left hemiparesis, suggesting involvement of the right cerebrum. Later, weakness of the right side and mental dysfunction indicated that both hemispheres had become involved. I think that the disease was diffuse in the cerebrum. Presumably the pons and medulla were not affected directly since there were no cranial nerve signs. The spasm of the toe requires some explanation, perhaps these attacks were in the nature of Jacksonian convulsions.

A number of things may be considered in differential diagnosis. An apoplectic onset may occur in disseminated sclerosis. The age of the patient favors this diagnosis. The ability to move one extremity or the other on occasions is hard to explain, and might possibly happen in disseminated sclerosis. The story of urgency and frequency suggests that something was wrong before the onset of the final illness in September. In disseminated sclerosis the CSF may be normal. The normal cell count, protein, and gold curve, while not in favor of disseminated sclerosis, are also not suggestive of any other general disease of the central nervous system.

There are a number of points against this diagnosis. Hemiplegia in disseminated sclerosis is rare; it occurs in about 3 per cent of cases. The short duration of the illness is much against the diagnosis.

One must consider whether this patient had a disease productive of cerebral emboli. There was slight evidence of myocardial damage on the first admission. The tachycardia which was present throughout the disease may indicate heart involvement. Roentgen examination showed cardiac enlargement late. The duration of the illness would fit this concept.

Against endocarditis was the absence of a heart murmur, there was no splenic enlargement and blood studies were normal. That the patient had no fever until the onset of pneumonia is against this diagnosis,

as are the negative blood cultures. Abnormalities in the CSF are usual in subacute bacterial endocarditis.

I think there are a number of other things to be considered but not too seriously. In encephalitis, the CSF usually is helpful in diagnosis. A luetic infection is unlikely because of the normal blood and CSF. Multiple neoplasms or aneurysm might be thought of, but they probably would have given signs in the CSF. The cerebral type of Buerger's disease is to be mentioned.

I consider the diagnosis to be between an acute fulminating type of disseminated sclerosis or multiple cerebral emboli.

Clinical Diagnosis

Multiple areas of encephalomalacia in the distribution of the left middle cerebral artery.

Old softening in posterior limb of right internal capsule.

Lobular pneumonia.

Doctor Salzer's Diagnosis

Acute fulminating type of disseminated sclerosis or multiple cerebral emboli.

Terminal bronchopneumonia.

Anatomical Diagnosis

Multiple areas of cerebral softening, chiefly of the gray matter of the cerebral hemispheres, accompanying cerebral "vasoparalysis."

Lobular pneumonia.

Discussion of Pathology

Dr. I. Mark Scheinker: The abnormalities besides those in the nervous system were acute bronchitis, lobular pneumonia, fatty infiltration of the liver, cystic endometritis, and chronic perisalpingitis. The heart muscle was normal.

Examination of the nervous system was limited to the brain. The leptomeninges of the vertex were moderately thickened. Vertical sections revealed displacement of the ventricular system toward the right. The white matter of the left cerebral hemisphere was widened. The basal ganglia on the left were almost twice the size of those on the right. There was intense generalized congestion, and numerous small petechial hemorrhages were seen in the white and the gray substance bilaterally, particularly in the swollen left hemisphere.

The histologic examination revealed maximal dilatation and congestion of the capillaries and small veins, which showed the signs of vasoparalysis. Many of the smaller blood vessels revealed degenerative changes or complete necrosis of the wall through which serous fluid and red blood cells had permeated.

A striking manifestation of circulatory disturbances was the early stages of thrombus formation. The lumen of numerous small veins was occluded by clots, composed of strands of fibrin mixed with large masses of platelets and white blood cells. In some of the veins the clot seemed to be slightly attached to the intima. Many of the occluded veins disclosed degenerative changes of their walls. Some of the veins contained a relatively small number of fibrin threads, in them the clot was formed chiefly of clumped platelets and degenerated white blood cells. Late stages of thrombosis were not to be seen.

These vascular lesions, which we believe signify various stages of functional vascular disturbance, were found scattered throughout the brain. They were more marked in pial veins and in the small vessels of the cortical ribbon, though they were present also in the subcortical white matter of the left hemisphere.

Changes in the parenchyma, secondary to the circulatory disturbance, consisted mainly of widely disseminated areas of softening. Most of the lesions stopped abruptly before the subcortical white matter was reached; only in a few instances the latter was involved minimally. Occasional small disseminated foci of softening were seen in the white matter. The pia overlying the large cortical lesions was not thickened, but contained a great number of tremendously congested large veins. The deeper part of the cortical ribbon was destroyed and replaced by fat granule cells and newly formed capillaries. The larger perforating vessels disclosed signs of stasis and were occasionally surrounded by thick sleeves of gitter cells.

There were disseminated areas of glial scar formation. The parenchymal change was generalized throughout the brain.

The subcortical white matter showed advanced edema, an alveolar sieve-like appearance with the formation of numerous large vacuoles separated from one another by thin trabeculae. The nervous tissue appeared quite cellular because of the increase of swollen oligodendroglial cells. Most of the swollen glia cells showed regressive changes.

It is to be emphasized that structural changes were not present in the large vessels. It will be recognized that these disseminated lesions corresponded in detail with those which are considered characteristic of softening of vascular origin. Such changes are observed in cases of thrombosis due to arteriosclerosis, syphilis, etc. None of the latter diseases was operating in this case. It may be reiterated that the vascular alteration consisted of congestion, stasis, and vasoparalysis, with associated thrombus formation, chiefly of the smaller veins and capillaries. The large majority of the smaller blood vessels was occluded.

What is the pathogenesis of thrombus formation in smaller veins? It seems possible that the lesion might be a late sequella of a prolonged state of vasoparalysis. The restriction of blood flow might be thought to result in thrombus formation. Why such a process should occur in a young woman, previously healthy, is inconceivable.

Doctor George Engel: If vou are postulating this picture on the basis of thrombosis of small veins, beginning as vasoparalysis and ending with thrombosis, it seems to me one should find much older thrombi in a condition lasting 74 days.

Dr. Charles D. Aring: There is some evidence that such vessels may be absorbed. This postulate has been advanced to explain comparable lesions in disseminated sclerosis, in support of the theory of venular thrombosis as the basis of that disease.

Doctor Engel: It would seem that the essential lesion of disseminated sclerosis could not be secondary to small venous thrombosis, since in this case with multiple venous thrombosis the lesions are not those of disseminated sclerosis.

Doctor Scheinker: The factor responsible for the vascular lesions observed in disseminated sclerosis is unknown. Venous occlusion is probably only one of several factors in the pathogenesis of multiple sclerosis. The sclerotic plaque formation is a slowly developing process. The reaction of the nervous tissue to venous occlusion is probably not always the same. It will depend among other things on the duration and intensity of the circulatory disturbance and the vascularity of the nervous tissues ("local factor").

Doctor Engel: How long do you presume it took to produce the marked softening in this case?

Doctor Scheinker: That could have happened in a few days or a week. Gitter cells may be seen within 36 to 48 hours after vascular occlusion.

Doctor Aring: We usually teach that there are three types of cerebrovascular lesions, hemorrhage, thrombosis, and embolism. In doing so we fully realize that we do not know much about the dynamics of these conditions. I would not like the students to leave with the idea that in hemorrhage a vessel ruptures within the cerebrum. Those who have examined much pathological material know that in cerebral softening, a thrombus is seldom found, and that in cerebral hemorrhage a ruptured artery is practically never found. Possibly these vascular changes in the brain are predicated somewhat on abrogation of the physiologic control of cerebral circulation. Possibly cerebral hemorrhage or thrombosis is the result of the changes which we have seen in this case—namely functional vascular changes. The prolongedly fast pulse and mild electrocardiographic change may have been indicative of functional cardiovascular disorder, which would complement the functional cerebrovascular disorder.

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